



# Air Force Research Laboratory|AFRL

*Science and Technology for Tomorrow's Air and Space Force*

## **Success Story**

### **BIO-INSPIRED ALGORITHMS ALLOW UAVS TO ACT AS TEAMS**



Just like geese, humans do not need complicated formulae to fly formations. Both geese and humans rely on simple rules coupled with simple communications and location information that interact to emerge the desired formation. The leader is the only vehicle that needs to know where its location is and where it is going; all other vehicles fly positions from the leader determined by simple rules, leaving their throughput free to run other algorithms such as threat locating or weapons management.

New bio-inspired algorithm technologies will allow groups of unmanned air vehicles (UAVs) to act as teams, similar to current manned aircraft. Embedding teaming capabilities will increase the UAV operator's span of control, decrease communication bandwidths, and increase operational flexibility.



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## **Accomplishment**

The Air Vehicles Directorate's futuristic program exploring UAV strike package teaming is the Integrated Tactical Aircraft Control (ITAC) program, which has successfully demonstrated formation flight capability using biologically inspired multi-UAV control algorithms. These algorithms simplistically and elegantly capture how pilots fly formations while reducing system throughput and communication requirements, easing integration into real-world systems.

Formation management software agents collect the algorithms and integrate them into the greater ITAC architecture. The formation steering agent manages these steering modes, switching intelligently between them as commanded or as the situation requires.

The rejoin mode determines a trajectory for one vehicle to efficiently maneuver into formation with another vehicle and provides steering commands to the vehicle along that trajectory. The UAV operators switch between different turn modes to perform more energy-efficient maneuvering while in formation. Its creator received the prestigious Perkin's Award for in-house research excellence for this work.

## **Background**

ITAC is the directorate's international, collaborative, autonomous control development program for multiple combat UAVs. Boeing and Dassault Aviation, in conjunction with the directorate and the French Ministry of Defense, jointly pursued the development of autonomous control technologies for combat UAVs.

The directorate is responsible for several of the software agents making up the ITAC software architecture. Besides the Formation Management Agent described above, the directorate also built the Vehicle Integrity Manager and System-Wide Integrity Manager, and they are currently transitioning these to other laboratory autonomous control technology development efforts.

## **Additional information**

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (03-VA-07)

Air Vehicles  
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